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Project Summary

Methodologies for Quantifying Pollution Prevention Benefits from Landfill Gas Control and Utilization

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This report presents a methodology and examples for developing air pollutant emission factors and emission estimates for comparing air quality impacts associated with landfill gas (LFG) control and utilization equipment and other energy sources (e.g., coal, natural gas) on a common basis. The methodology also provides the necessary information to prepare uncontrolled and controlled landfill emission inventories of carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide, carbon dioxide, and methane. LFG flaring is the only control option addressed in this report, while the utilization options include reciprocating internal combustion (RIC) engines, steam and gas turbines, and boilers.

The report includes examples of how to use the data and methodology presented. The examples compare the air pollutant emissions expected from control or utilization of the LFG from an example landfill using a flare, a RIC engine, a gas turbine, and a boiler. The example assessment also compares the LFG utilization options to emissions expected from an equivalent amount of energy input to a coal-fired steam power plant, a natural gas turbine plant, a natural-gas-fired boiler, and a distillate-oil-fired boiler. Annual emissions are summarized from an uncontrolled landfill and from a landfill following control or utilization with a flare, RIC engine, gas turbine, or boiler.

This Project Summary was developed by EPA's National Risk Management Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Municipal solid waste landfills are required under the New Source Performance Standards to install LFG collection and control or utilization systems to reduce emissions of non-methane organic compounds (NMOCs), hazardous air pollutants (HAPs), odorous substances, and compounds with an explosion potential (e.g., methane). LFG control systems refer to flares, where there is no recovery of the associated energy. On the other hand, LFG utilization refers to the recovery of LFG energy either as primary heat (e.g., industrial boiler or space heater) or as a fuel source to drive electricity generating equipment. Currently, these are the most common utilization options.

Primary emissions from municipal solid waste landfills, such as methane (CH_4) and NMOCs, can be combusted in either a control or utilization device. However, systems used to control or utilize LFG (e.g., flares, internal combustion (IC) engines, gas turbines, and boilers) produce emissions of NO_x and CO, often referred to as secondary emissions. Since CO and NO_x emissions are of concern in nonattainment areas, methods are needed to comparatively assess emissions resulting from LFG control/utilization with other forms of energy production. Also, greenhouse gas emissions from landfills are of global concern, and therefore, a compari-

son of the net benefits associated with LFG control or utilization and other forms of energy production is often of interest.

Methods to Develop Emission Factors and Emission Inventories

Methods to develop emission factors from each control/utilization option are included. The emission factors developed for comparison to other energy sources are designated EF_{col} to represent that only emissions associated with the combustion of the collected LFG are included. These emission factors will provide the best comparisons for alternative energy sources, since the emissions associated with collecting those fuels (e.g., coal mining, petroleum extraction, and refining) are not represented in published emission factors.

Methods to prepare uncontrolled and controlled emission inventories are presented along with the discussion of developing emission factors for the collected LFG. The controlled emission inventories, however, include emissions from both the control/utilization equipment and uncollected LFG.

Example LFG Control or Utilization Assessment

An example assessment is included that illustrates the use of the data and methods presented. The example provides emission factors in pounds per kilowatt-hour for IC engines and gas turbines fired on LFG compared to emissions from an equivalent amount of energy input to a coal-fired steam power plant and a natural gas turbine power plant. Also in the example, emission factors are developed for a LFG boiler and compared to emission factors from an industrial boiler fired on either natural gas or distillate oil. Annual emission inventories were prepared for each utilization option and comparison energy source and presented along with an annual inventory of emissions following flare control. The annual amount of electricity produced for each power-generating utilization/comparison energy source is also presented.

An annual emissions inventory of uncontrolled versus controlled landfill emissions (using a flare, IC engine, turbine, or boiler) is also presented.

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The complete report, entitled "Methodologies for Quantifying Pollution Prevention Benefits from Landfill Gas Control and Utilization," (Order No. PB95-243176, Cost: $17.50, subject to change) will be available only from
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